Syphilis, gonorrhoea, and drug abuse among pregnant women in Jefferson County, Alabama, US, 1980–94: monitoring trends through systematically collected health services data

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Objective: To assess the association between self reported drug abuse and syphilis and gonorrhoea among pregnant women, Jefferson County, Alabama, United States, 1980–94.
Study design: We analysed a prenatal care database and assessed the association of self reported drug use with seropositive syphilis and gonorrhoea using prevalence rates, multiple logistic regression models, and the Pearson correlation coefficient (*r*) for trends.
Results: Overall, 5.5% of the women acknowledged drug abuse, 1.4% had seropositive syphilis, and 4.8% had gonorrhoea. In a multivariate analysis, drug abuse was associated with syphilis (odds ratio 2.9, 95% confidence interval 1.6, 5.3) but not with gonorrhoea. Trends in the annual prevalence of drug abuse closely paralleled trends in the annual prevalence of syphilis, including simultaneous peaks in 1992 (drug abuse, 9.1%; syphilis, 3.2%). There was no such parallel trend between drug abuse and gonorrhoea. Annual prevalence of drug abuse correlated with the prevalence of syphilis ($r = 0.89$, $p = 0.001$) more than with the prevalence of gonorrhoea ($r = 0.45$, $p = 0.201$).
Conclusion: Among pregnant women, an increase in drug abuse was closely associated with an epidemic of syphilis, but not of gonorrhoea. Systematically collected prenatal care data can usefully supplement surveillance of diseases and behavioural risk factors associated with them.
(*Sex Transm Inf* 1999;**75**:300–305)

Keywords: drug abuse; sexually transmitted diseases; pregnancy; surveillance

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Introduction

In the United States, reported rates of syphilis among adults increased during the late 1980s, contributing to a secondary epidemic of congenital syphilis, while the reported rates of gonorrhoea decreased.[1][2] Because syphilis and gonorrhoea are primarily sexually transmitted, one might expect that their epidemiological pattern would also be similar. Many cross sectional studies have shown that the use of illicit drugs, particularly "crack" cocaine, is a risk factor for syphilis.[3–7] However, an association between drug use and gonorrhoea has not been shown consistently.[3–7] To our knowledge, other than ecological comparisons,[8][9] there have been no individual level studies correlating syphilis or gonorrhoea with that of drug abuse over time.

Most sexually transmitted disease (STD) surveillance reports do not contain information on factors that contribute to STDs (for example, illicit drug use or access to care).[1] Ongoing surveys that collect information on drug abuse usually do not collect information on STDs.[10][11] Moreover, the healthcare seeking behaviours of substance users may be different from those of people who do not use illicit drugs, and drug abusers may have higher rates of STDs than others. This lack of data can be corrected to some extent by using data from people who attend services that are not primarily related to STDs or drug abuse. Such data can contribute to assessing the community prevalence of a disease or a risk factor for a disease, such as drug abuse, and will probably yield important information on the correlation between such risk factors and disease transmission.

Although data abstracted from clinical records have been used for research,[12–14] we found no report of the use of routinely collected data from healthcare services for the monitoring of STD trends over time. This study makes use of the prenatal care records from the automated obstetric medical records system of the University of Alabama at Birmingham and from the Jefferson County, Alabama, maternity and infant care project from 1980 to the end of 1994. This database contains information on a broad set of maternal characteristics, including infections and various behavioural risk factors for infections and adverse pregnancy outcomes, such as drug abuse, alcohol use, and smoking. The findings here describe the trends in syphilis, gonorrhoea, and self reported drug abuse in a non-STD clinic setting, and the importance of routinely collected health services data for the surveillance of STDs and risk behaviours associated with them.

Methods

The obstetric medical records system operated by the University of Alabama at Birmingham collects prenatal and delivery data from pregnant women who seek care in the public

prenatal clinics in Jefferson County, Alabama. This data system is described in detail elsewhere.[15]

Screening for behaviours and infections related to adverse maternal and fetal outcomes are carried out as a part of routine assessment performed in the Jefferson County health department prenatal clinics in accordance with the recommendations by the American College of Obstetrics and Gynecology and the Centers for Disease Control and Prevention.[16][17] All women provide consent to prenatal care, which include a number of routine laboratory examinations, but is not specific to any single laboratory test. Refusal of specific laboratory tests or behavioural risk assessment are rare.

Information on each woman seeking prenatal care is collected during her initial visit, and each woman's subsequent clinical history is recorded during succeeding visits and at the time of her delivery. Data collected include demographic information; reproductive history; past medical history; patient reported current and past high risk behaviours including the use of alcohol, tobacco, and illicit drugs such as cocaine, marijuana, crack, heroin, LSD, crystal, speed, and sleeping pills; and results of laboratory examinations. Information on the woman's history of use of alcohol, tobacco, or illicit drugs is obtained through routine interviews as part of the obstetric risk assessment. Although the interview on drug abuse is specific as to the types of illicit drugs used and whether drug abuse was current or past, the information was recorded in the database only as a "yes/no" item.

All women are tested for syphilis and gonorrhoea during their first prenatal visit and again between the 32nd and 37th week of gestation. Syphilis is diagnosed on the basis of results of serological tests. A positive venereal disease research laboratory (VDRL) test for women with no history of diagnosis or treatment for syphilis is confirmed by microhaemagglutination assay for antibody to *Treponema pallidum* (MHA-TP), and a diagnosis of syphilis is made if positive results are obtained for both tests. Among women with a history of diagnosis or treatment for syphilis, a fourfold increase in VDRL titre is considered diagnostic for syphilis. Therefore, in this report the prevalence of syphilis refers to the prevalence of seropositive syphilis. Gonorrhoea is diagnosed on the basis of a positive cervical swab culture. Centers for Disease Control and Prevention (CDC) guidelines are followed in the management of patients who have positive results for syphilis or gonorrhoea.[17]

In this analysis, we included only women who had at least one prenatal care visit for the index pregnancy in the Jefferson County prenatal clinics. We included laboratory test results from either of the two tests during each pregnancy to determine the prevalence of syphilis and gonorrhoea. If a woman had only one prenatal care visit in the Jefferson County prenatal care clinics during the index pregnancy, then the result from that test was included. Information on laboratory tests performed or prenatal care received in clinics other than in Jefferson County prenatal clinics was not recorded.

We calculated the prevalence rates of drug abuse, syphilis, and gonorrhoea. Prevalence rates were obtained by study year for the overall sample and for age-race subgroups. Stratified prevalence rates were obtained for the overall sample by age ($\leqslant 19$ years, $\geqslant 20$ years); race (white, black); level of education (11 years or less, 12 years or more); marital status (married, unmarried); self reported history of STD; and self reported history of smoking, alcohol drinking, and drug abuse. Prenatal records in which information for one of the above listed variables was incomplete were excluded from the analysis. Multivariate logistic regression models were used to describe associations of each of these variables separately for syphilis and gonorrhoea. Year of diagnosis was grouped into three periods (1980–4, 1985–9, and 1990–4) and was entered into the logistic regression model. Initially we excluded from the model any variable with a p value greater than 0.20. If a variable that we judged to be of epidemiological importance was excluded, we put that variable back into the model. This process of exclusion or retention of variables continued until all the variables not in the model were significant ($p<0.05$) and the variables not in the model had no appreciable effect on the coefficients of variables that remained in the model. Interactions among the variables in the final model during the three time periods were also examined through logistic regression. Pearson correlation coefficients were calculated to determine the relation of the prevalence over time of gonorrhoea and seropositive syphilis with that of drug abuse and other variables that the logistic regression model identified as being associated with syphilis or gonorrhoea.

Results

From 1980 to the end of 1994, of the 63 673 women who had at least one prenatal care visit in the Jefferson County prenatal clinic system, we excluded prenatal care records of 1936 (3%) women who had incomplete data on any one of the variables listed in table 1. The number of women whose prenatal records were incomplete in the following variables were; 358 (0.4% of all women) on syphilis or gonorrhoea tests, 289 (0.5%) on drug use, 189 (0.3%) on race, 101 (0.2%) on education, 58 (<0.1%) on age, 292 (0.5%) on marital status, 312 (0.5%) on smoking or alcohol use history, and the remaining 337 (0.5%) on STD history. The distribution by race of the 1936 women who were excluded was similar to the sample of women who were included in the study. However, women who were excluded from the analysis were more likely to be older (20 years or older, 72%) than those in the study sample (66%) ($p<0.05$).

Our analysis was restricted to the prenatal care records of the remaining 63 673 women. During the 15 year period, the age and racial composition of the study population did not change significantly. A majority of the women were 20 years or older, black, unmarried, or

Table 1 Prevalence of drug abuse, syphilis, and gonorrhoea among pregnant women, Jefferson County, Alabama, 1980–94

	Study population Number (%)	Prevalence rate (%)		
		Drug abuse*	Syphilis	Gonorrhoea
Total	62 673 (100)	5.5	1.4	4.8
Age (years)				
19 or younger	28 018 (44)	4.2†	1.1†	6.6†
20 or older	35 655 (56)	6.4	1.7	3.4
Race				
white	18 481 (29)	10.0†	0.6†	1.1†
black	45 192 (71)	3.6	1.8	6.3
Education (years)				
11 or less	27 379 (43)	6.5†	1.4‡	5.5‡
12 or higher	36 294 (57)	4.8	1.5	4.4
Marital status				
married	19 739 (31)	4.5†	0.8†	1.5†
unmarried	43 934 (69)	5.8	1.7	6.2
Drug abuse*				
yes	3 502 (6)	—	3.4†	5.1‡
no	60 171 (94)	—	1.0	4.8
Smoking*				
yes	17 192 (27)	14.0†	1.7†	5.2†
no	46 481 (73)	2.0	1.3	4.0
Alcohol use*				
yes	8 915 (14)	18.4†	2.1†	4.8‡
no	54 758 (86)	3.4	1.4	4.8
History of STD*				
yes	12 098 (19)	9.4†	3.4†	7.0†
no	51 575 (81)	4.5	1.0	4.3
Year of event				
1980–4	20 375 (32)	2.8†	0.8†	4.6‡
1985–9	21 013 (33)	4.9	0.8	4.9
1990–4	22 285 (35)	8.1	2.4	4.8

*Self reported information, χ^2 test for homogeneity among subgroups; †p<0.05; ‡p>0.05.

had 12 or more years of education (table 1). The percentage of women who were single increased from 51% in 1980 to 72% by 1994 (χ^2 for trend, p<0.001). Between 1980 and 1994, there was no significant difference in the percentage of women who acknowledged alcohol use (average, 14%), whereas the percentage of women who smoked decreased from 32% to 23% (χ^2 for trend, p=0.001).

DRUG ABUSE

Overall, 5.5% of pregnant women acknowledged using illicit drugs. The prevalence of drug abuse varied significantly among all subgroups of women. The prevalence of drug abuse was greater among women who were older, white, less educated, unmarried, smokers, alcohol drinkers, or had a history of STDs

Figure 1 Prevalence of drug abuse, syphilis, and gonorrhoea among pregnant women, Jefferson County, Alabama, 1980–94.

than among other subgroups of women (table 1). The prevalence of drug abuse varied among age race subgroups of women. Among women aged 19 years old or younger, the prevalence of drug abuse was five times higher among white women (9.5%) than among black women (1.8%) (p<0.05), whereas among women aged 20 years or older it was only 2.3 times higher among white women (10.6%) than black women (4.6%) (p <0.05).

The prevalence of drug abuse varied little by year during 1980–4 (2.8%), but it began to increase after 1985 and peaked at 9.1% in 1992 (fig 1). The peak year for drug abuse varied among age-race subgroups of women. Among women aged 19 years or younger, the prevalence of substance use peaked in 1992 (6.3%), and among those aged 20 years or older it peaked in 1993 (11.3%).

SYPHILIS

Overall, 1.4% of pregnant women had a serological diagnosis of syphilis. The prevalence of syphilis varied significantly among all subgroups of women except among the subgroups by level of education (table 1). The prevalence of syphilis was greater among women who were aged 20 years or older, black, unmarried, who acknowledged the use of illicit drugs, alcohol, or tobacco, and who had a history of STDs compared with other subgroups of women.

Overall, the prevalence of syphilis was low (0.8%) during 1980–4 and began increasing in 1987. The largest increase in syphilis prevalence was from 1990 on. It peaked in 1992 at 3.2%, and then declined (fig 1). During 1980–4, the years with the lowest prevalence of syphilis, the prevalence of syphilis among black women (1.0%) was twice as high as that among white women, whereas during 1990–4, the years with the highest prevalence of syphilis, syphilis among black women (3.0%) was three times as high as that among white women (p<0.05). The peak year of syphilis prevalence varied among age-race subgroups of women. Syphilis prevalence among women aged 19 years or younger peaked in 1992 (2.0% for whites, 2.9% for blacks), and among women 20 years or older it peaked in 1993 (1.4% for whites, 4.4% for blacks). The increase in syphilis rates from 1985 to 1993 and subsequent decreases were consistent across various subgroups of pregnant women. Among drug abusers the prevalence of syphilis peaked in 1993 at 6.9% and among non-users it peaked in 1992 at 2.6% (fig 2).

In the multivariate logistic regression model, age 20 years or more (odds ratio (OR) 1.8; 95% confidence interval (CI) 1.1, 2.8), black race (OR 2.7; 95% CI 1.4, 5.5), drug abuse (OR 2.9; 95% CI 1.6, 5.3), smoking (OR 1.4, 95% CI 1.2; 1.7), and history of STDs (OR 2.8; 95% CI 1.9, 4.3) were associated with syphilis. Adjusting for all the variables in the final model, we found that the prevalence of syphilis was significantly higher during 1990–4 (OR 2.6, 95% CI 1.7, 4.0) than during previous years.

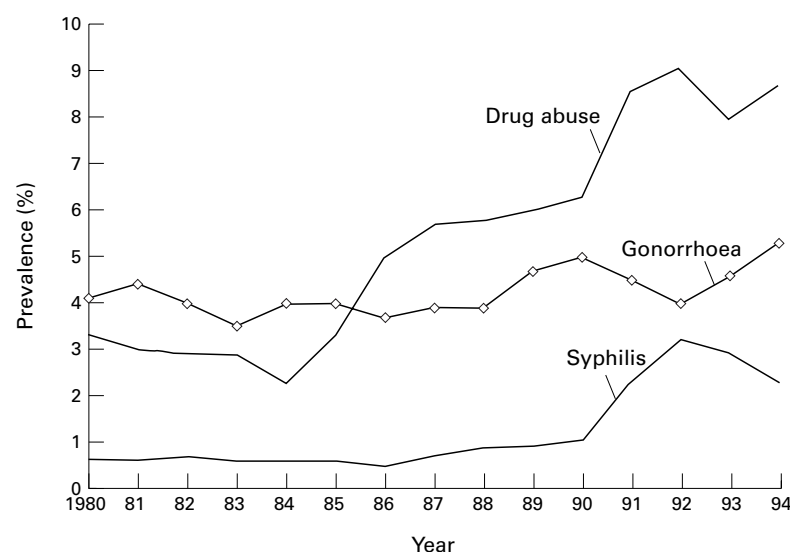The trends in the annual prevalence of drug abuse and in the annual prevalence of syphilis
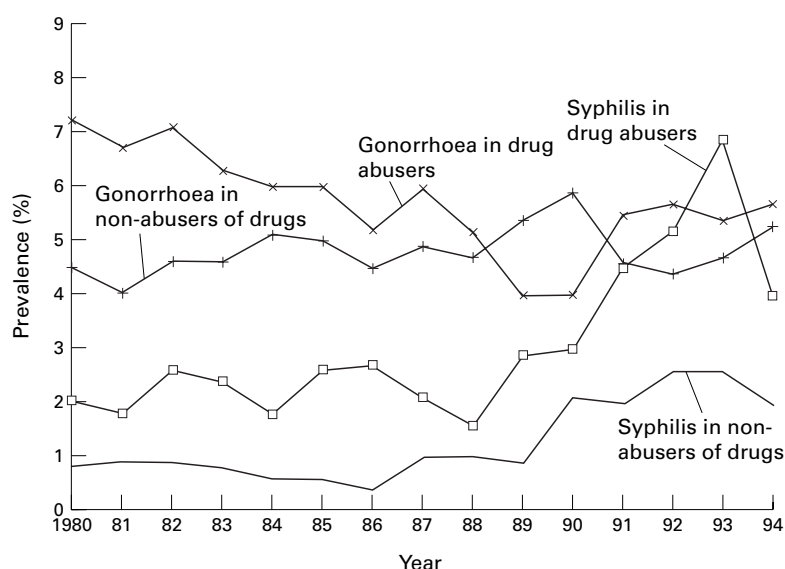
Figure 2   Prevalence of syphilis and gonorrhoea by drug abuse among pregnant women, Jefferson County, Alabama, 1980–94.

were parallel, including simultaneous peaks in 1992 for drug use and syphilis, both of which subsequently declined (Pearson correlation coefficient (r) = 0.89, p = 0.001) (fig 1). The correlation was significant among black women 20 years or older (r = 0.94, p <0.001), among white women 20 years or older (r = 0.73, p = 0.002), and among white women 19 years or younger (r = 0.53, p = 0.039), but not among black women 19 years or younger (r = 0.35, p = 0.201).

GONORRHOEA
Overall, 4.8% of pregnant women had a diagnosis of gonorrhoea. The prevalence of gonorrhoea varied significantly among all subgroups of women except among the subgroups by education, drug use, or alcohol use (table 1). The prevalence of gonorrhoea was greater among women who were aged 19 years or younger, black, unmarried, smokers, and who had a history of STDs compared with other subgroups of women. By age-race groups, the prevalence of gonorrhoea among women aged 19 years or younger was 6.6 times higher (p<0.001) among black women (7.9%) than white women (1.2%) whereas among those aged 20 years or older, the prevalence of gonorrhoea was five times higher among black women (4.1%) than among white women (0.8%) (p<0.05).

During the study period, the prevalence of gonorrhoea did not show any distinct association with the prevalence of drug abuse (table 1, figs 1 and 2). The overall increase in prevalence of gonorrhoea between 1988 and 1990 (fig 1) was mainly due to an increase in the prevalence of gonorrhoea among women who reported no drug use and not among those who did report drug abuse (fig 2). The trends in the prevalence of gonorrhoea over time were different for different subgroups of pregnant women. The prevalence of gonorrhoea decreased among white women of all ages (1980, 1.9%; 1994, 1.0%, p=0.035), increased among black women aged 19 years or younger (1980,

7.9%; 1994, 9.5%, p=0.015), and remained stable in other subgroups of pregnant women (p>0.05).

In the multivariate logistic regression model, age 19 years or younger (OR 1.7; 95% CI 1.3, 2.2), 11 years or less education (OR 1.2, 95% CI 1.1,1.3), black race (OR 4.3; 95% CI 2.7, 7.0), unmarried status (OR 1.9; 95% CI 1.3, 2.7), and a history of STDs (OR 2.6; 95% CI 1.7, 4.0) were associated with gonorrhoea. Adjusting for all the variables in the model, we found that the prevalence of gonorrhoea among women aged 20 years or older was higher during 1980–1984 (OR 1.4; 95% CI 1.2,1.7) than during later years. Smoking was not significantly associated with gonorrhoea (OR 1.0; 95% CI 0.7, 1.4) except during 1980–4 (OR 1.4; 95% CI 1.1, 1.7). When forced into the logistic regression model for gonorrhoea, drug abuse did not reach significance at the 0.05% level (OR 1.2; 95% CI 0.9, 1.6).

The prevalence of drug abuse was not correlated with the prevalence of gonorrhoea in the overall sample (r = 0.45, p = 0.201) or among age-race subgroups of pregnant women.

Discussion
These results highlight the use of systematically collected health services data for surveillance of diseases and behaviours associated with them. Our analysis of routinely collected data from prenatal clinics indicates that pregnant women who acknowledged drug abuse were at increased risk for syphilis and that the trends in the prevalence of self reported drug abuse generally paralleled the trends in syphilis seroprevalence but not the trends in gonorrhoea prevalence. These data from a non-STD clinic population confirm earlier reports based on data from STD clinics of the divergence of trends in the rates of syphilis and gonorrhoea,[1 2] an association between syphilis and drug abuse, and variable associations between gonorrhoea and drug abuse.[3–8] The characteristics of women with syphilis or gonorrhoea identified in this study are consistent with findings from earlier reports.[1 2 5 7 8]

The limitations to be considered in interpreting the relation of drug abuse and syphilis using routinely collected data from prenatal clinics include self report bias, and the lack of information both on the types of drugs used and on the recency of use. Further, in public prenatal clinic settings, such as the ones we studied in which data are not collected with a research objective, over the 15 year study period, clinical interviews would have been administered by many different individuals in varying formats leading to inconsistencies in both assessment and response bias. Also, we do not have information on some patients who might have received care for STDs in facilities outside the prenatal care clinic system leading to some underestimation of the actual prevalence rates. Finally, syphilis diagnosis based on serological evidence should be interpreted with caution because of the possibility of detection of latent syphilis.[18]

Information based on self reported history of drug abuse is likely to underestimate the

prevalence of drug abuse and more so among women when drug abuse histories are obtained in the context of pregnancy.[19–21] A statewide study of 2970 pregnant women in Alabama which used urine tests to detect illicit drug use indicated higher prevalence of illicit drug use (11.0%) than the prevalence rate in our study for the corresponding years.[22] For comparison of trends in drug abuse over time, state, or county specific data for Alabama are not available. The National Household Survey on Drug Abuse (NHSDA), which began collecting information on pregnancy in 1994, indicated that the prevalence of drug abuse by pregnant women for 1994 and 1995 combined (9.9%)[11] was slightly higher than that found in our study for 1994 (7.8%). The proportion of pregnant women in our study who acknowledged drug abuse was several fold higher among those who acknowledged alcohol drinking and smoking than among those who did not. These results concur with reports that high risk behaviours tend to cluster in the same sub-populations.[7 19 21]

Our data do not provide information on the recency of drug abuse and only indicate the prevalence of lifetime drug abuse. The association of once in a lifetime use of an illicit drug such as marijuana with a recently acquired infection may be remote. Only the use of crack cocaine—but no other forms of drugs—has been consistently shown to be associated with the acquisition of syphilis which is attributed to trading sex for crack or money by crack users.[3–7] Both the pattern and type of illicit drugs used, and self reporting bias in drug use, may vary by race.[19–21] The variation in drug use by race and age in the self reported data in our study population was consistent with findings from the statewide study of drug use in Alabama.[22] The lower prevalence of syphilis despite a higher prevalence of drug abuse among white women compared with black women in this study may also be the result of a relatively low prevalence of syphilis among white women before the increases in illicit drug use, as has been reported in the midwestern region of the United States.[23] In 1990, in Dayton, Ohio, the midwestern region of the United States which is in a region with the lowest syphilis rates, none of the 138 women who used crack tested positive for syphilis despite the fact that 93% of these women had multiple sexual partners.[23]

Although the importance of collecting information from clinic records was noted early on by Florence Nightingale, systematic data collection was not initiated until the 1940s, even in Scotland.[24] With the exception of Israel, Canada, and some Nordic countries, that have integrated health information systems, ambulatory care data are not generally available.[25 26] Data from two ambulatory primary care networks, the Uniform Ambulatory Care Data Set (UACDS) in the United States and the Eurosentinel in Europe, indicate that unlike computerised hospital discharge data, data reporting systems from outpatient settings are less standardised and aggregation of such data is difficult.[13 27] Data from prenatal clinics have some advantages over data from other sources;

clinical practices in prenatal clinics are fairly uniform, women who attend prenatal clinics are generally not a population at risk for any given disease, screening for a variety of infections and risk behaviours is routine in prenatal clinics, and a prenatal clinic may be the sole healthcare facility attended by a woman during a year in which she is pregnant. With approximately four million deliveries each year in the United States and multiple visits for each,[28] information collected in prenatal clinics should be considered as an alternative low cost data source for public health surveillance. The increasing computerisation of health information should facilitate such use. In summary, although the available data from prenatal clinics are less complete than those from active surveillance sources, this analysis serves as an example of how routinely collected health services data from an non-STD clinic population may be used for surveillance of STDs and the behaviours that may be associated with their transmission. Clearly, there is a need for integrating clinical databases and public health resources for surveillance.

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